Examples of Assessments of Wetlands at the Watershed Scale

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Information is needed to:

- *Establish baselines and track trends*
- *Measure the success of wetland programs and regulatory actions*
- *Prioritize and target restoration and other management activities*
- *Include wetlands in watershed planning*

3-Tiered Approach

	Products/Applications
Level 1 - Landscape Assessment: Evaluate general condition of study area using readily available digital data.	•Status and Trends •Sample frame for site-level assessments
Level 2 – Rapid Assessment: Evaluate the general condition of individual wetlands using relatively simple indicators. Takes two people no more than a half day to do.	•401/404 permit decisions •Identify impacts and stressors •Regional or watershed assessments
Level 3 – Intensive Assessment Provide comprehensive data on individual wetlands. Takes four to six people a full day in the field.	•Evaluate and refine the rapid and landscape assessments •Provide diagnostic capability •Establish relationship with rapid assessment to extrapolate Level 3 information

Landscape Assessment Tools:

- *National Wetland Inventory Maps*
- *NWI with HGM classes*
- *Penn State's Landscape Assessment*
- *Weller's Landscape Analysis*
- *Brown's Landscape Development Index*
- *WED's Alternative Futures Approach*
- *Johnson's GIS-based Landscape Profiles*

Rapid Methods that Assess Condition:

- *Draft California Rapid Assessment*
- *Draft Delaware Method*
- *Massachusetts CZM Rapid Assessment Method*
- *Montana Wetland Assessment Method*
- *Ohio's Rapid Assessment Method*
- *Penn State's Stressor Check List*
- *Washington's Wetland Rating System*

Intensive Assessment Methods (Level 3)

- *Hydrogeomorphic Assessment (HGM)*
- *Index of Biotic Integrity (IBI)*
- *Traditional ecological approach*

EMAP Partnerships

Nanticoke Watershed (DE, MD) – Dennis Whigham, Don Weller, Tom Jordan, Amy Jacobs, Art Spingarn

Juniata Watershed (PA) – Rob Brooks, Denice Wardrop, Charlie Rhodes

Cuyahoga Watershed (OH) – John Mack, Siobhan Fennessy, Sue Elston

California – Josh Collins, Martha Sutula, Eric Stein, Paul Jones

New England – Bruce Carlisle, Cathy Wigand, Matt Schweisberg

PLUS Minnesota, Montana, Iowa, Colorado

Questions of Interest

- *What is the condition of the wetland resource?*
- *What are the predominant stressors?*
- *Where in the watershed are the wetlands in the best/worst condition found? the stressors?*
- *How have management decisions affected the resource over time?*

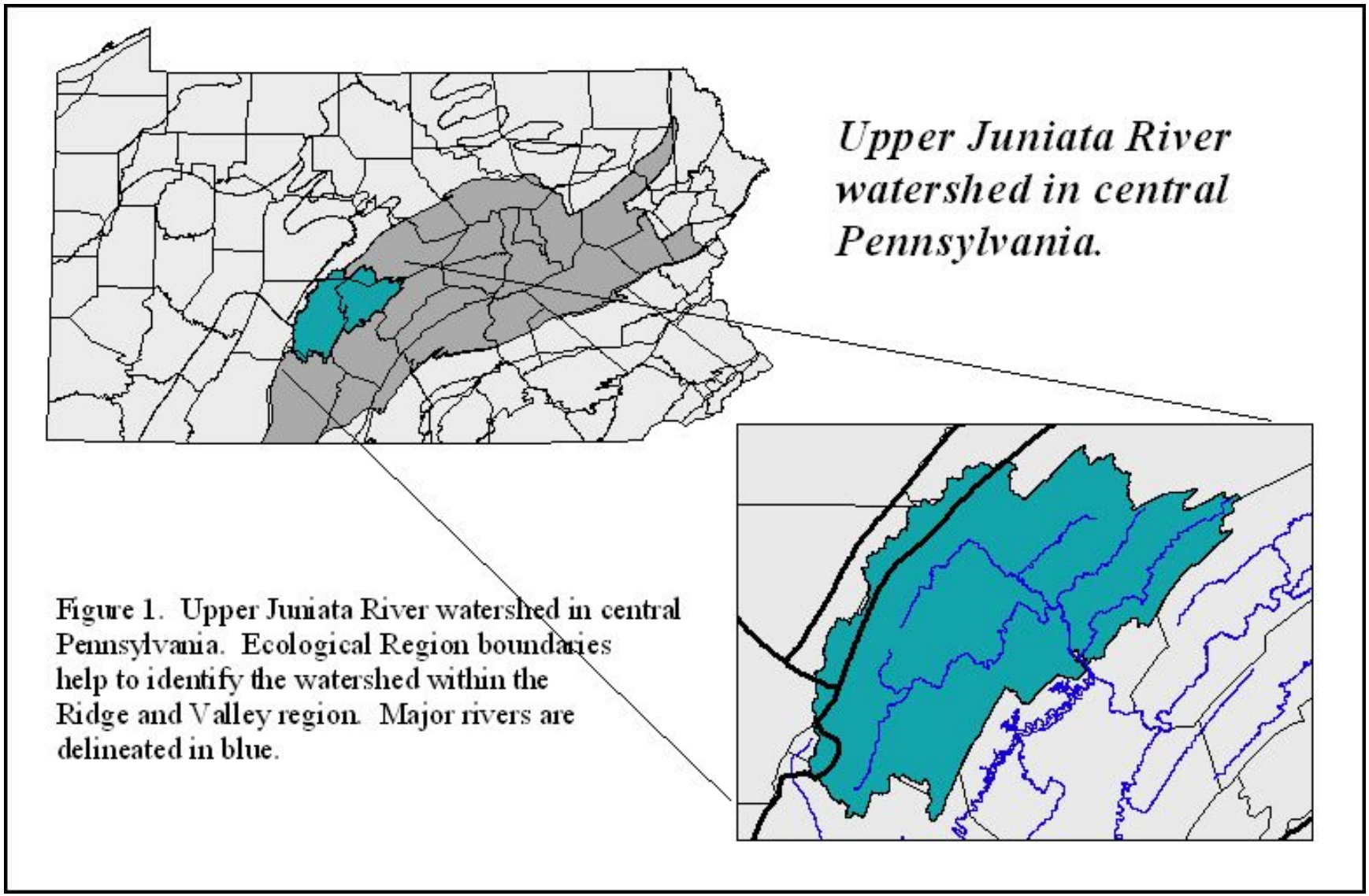
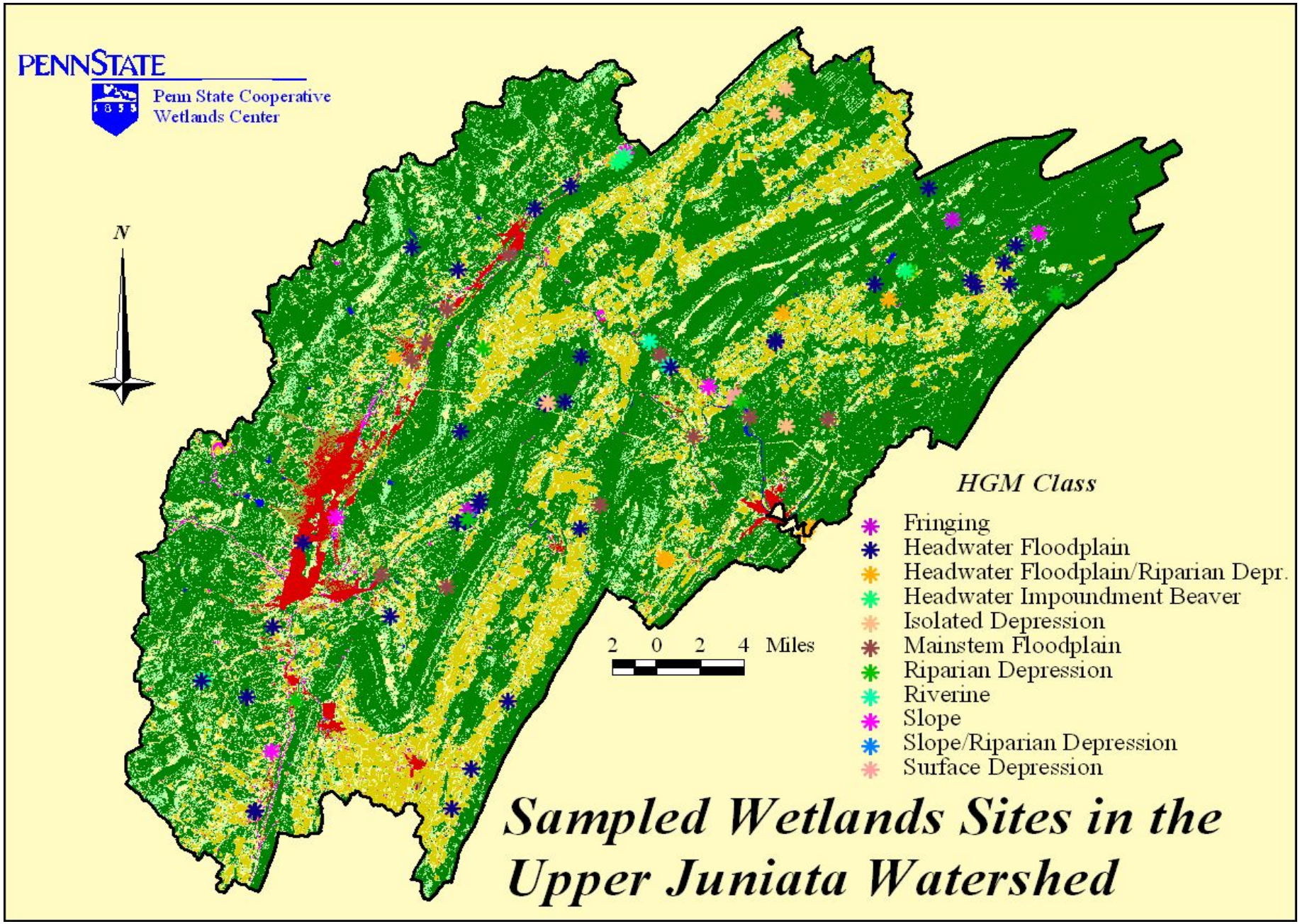


Figure 1. Upper Juniata River watershed in central Pennsylvania. Ecological Region boundaries help to identify the watershed within the Ridge and Valley region. Major rivers are delineated in blue.

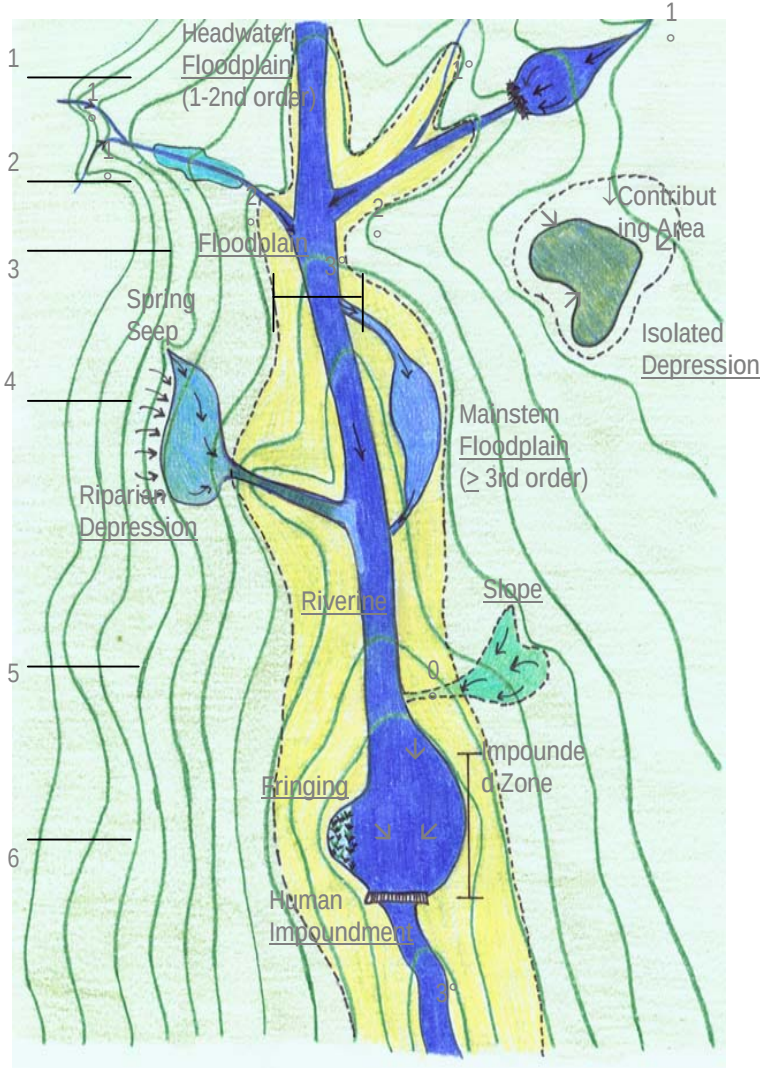
Courtesy of D. Wardrop, Penn State Cooperative Wetland Center



Courtesy of D. Wardrop, Penn State Cooperative Wetland Center

HGM Classification

Headwater Floodplain



Mainstem Floodplain

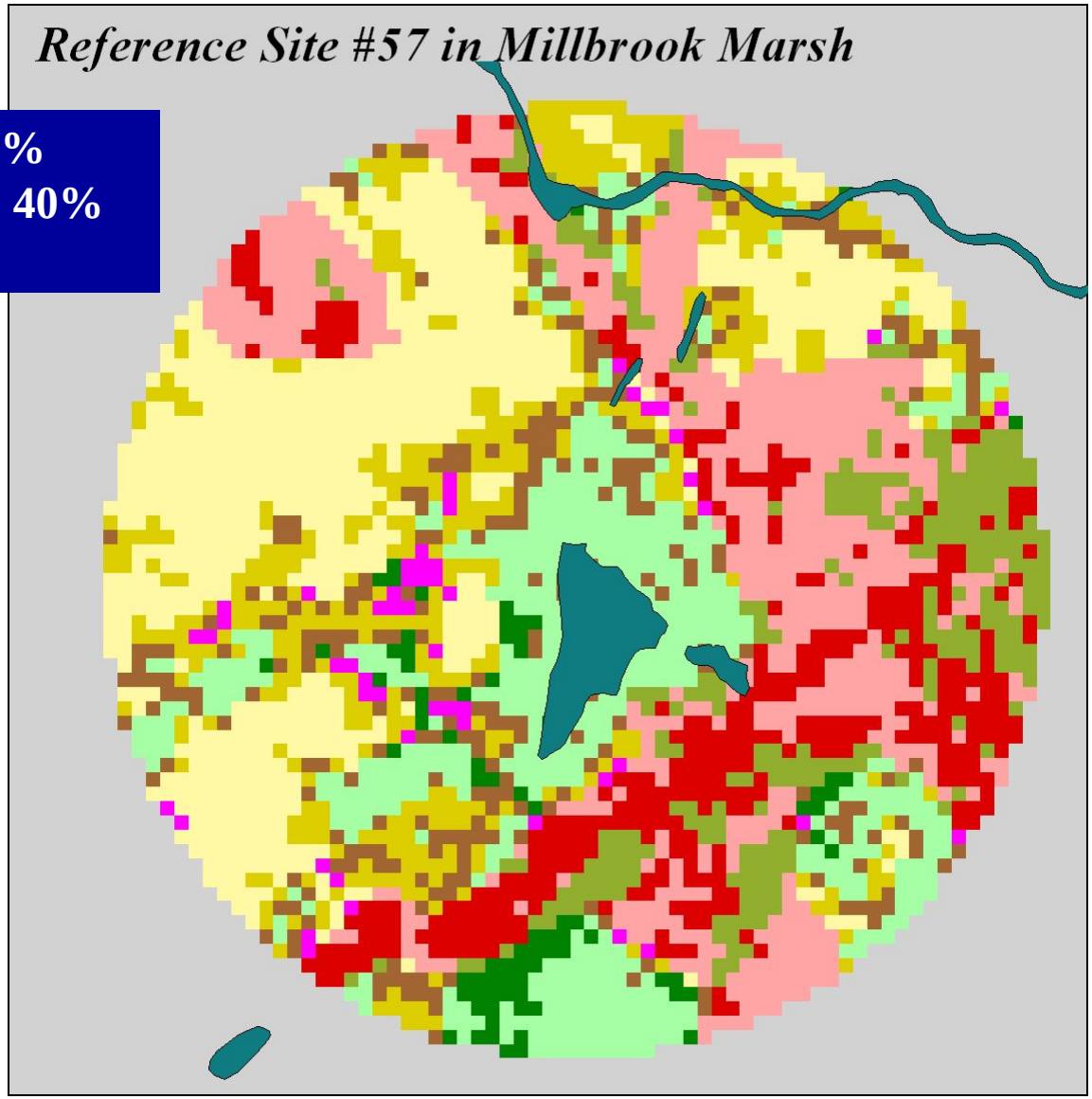
Riparian Depression

Slope

Courtesy of D. Wardrop, Penn State Cooperative Wetland Center

Courtesy of D. Wardrop, Penn State Cooperative Wetland Center

Courtesy of D. Wardrop, Penn State Cooperative Wetland Center



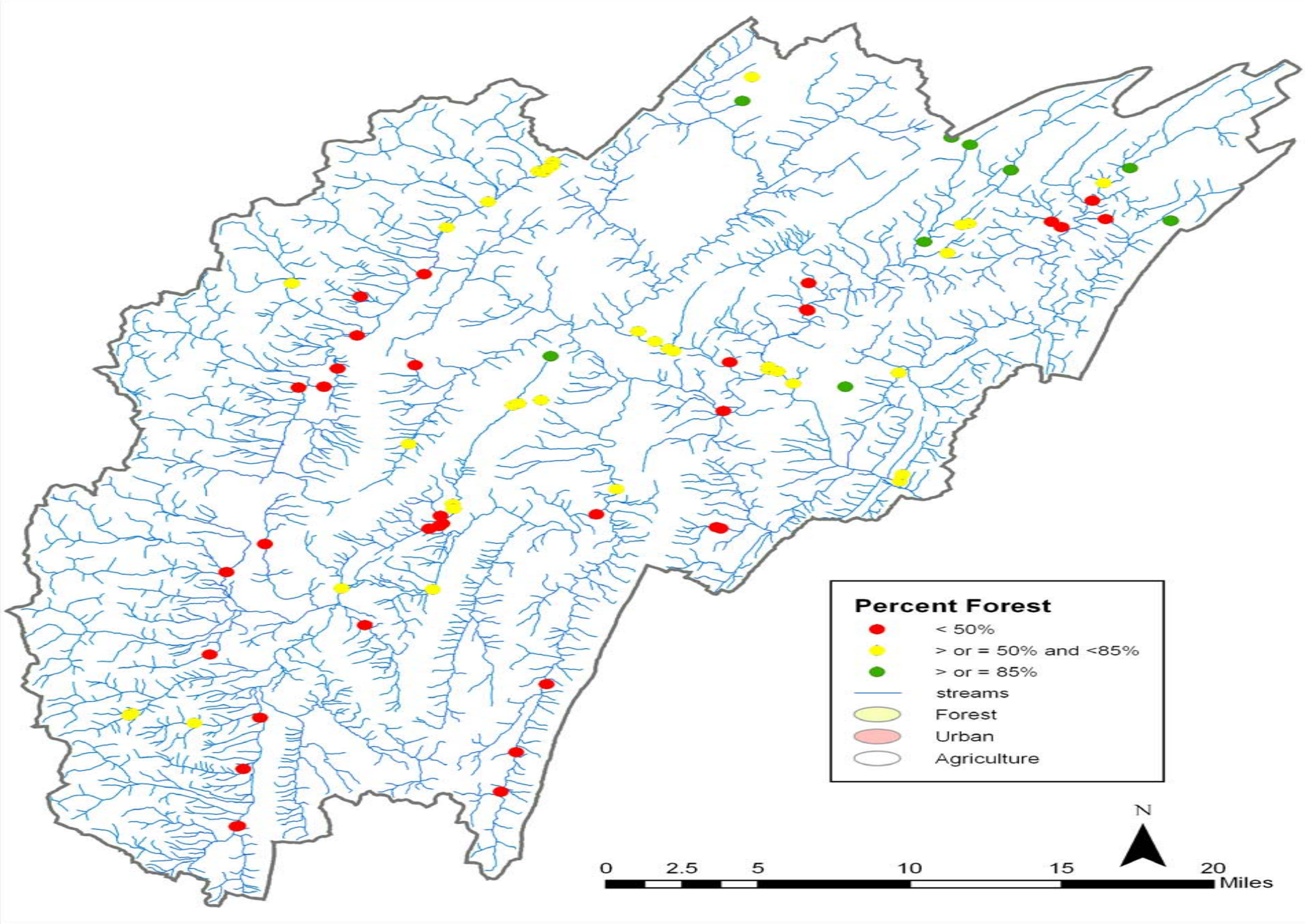
Courtesy of D. Wardrop, Penn State Cooperative Wetland Center

Juniata Assessment—Landscape-level Results

(n = 463)

Condition Category	Criteria	Percent of Resource	Area of Wetland (ha)
Best	≥85% Forested Land Cover	6.1 ± 1.6	129
Good	≥50% and <85% Forested Land Cover	45.1 ± 3.8	958
Fair	≥25% and <50% Forested Land Cover	36.5 ± 4.4	774
Poor	<25% Forested Land Cover	12.4 ± 2.9	262

From Wardrop et al. (in prep)



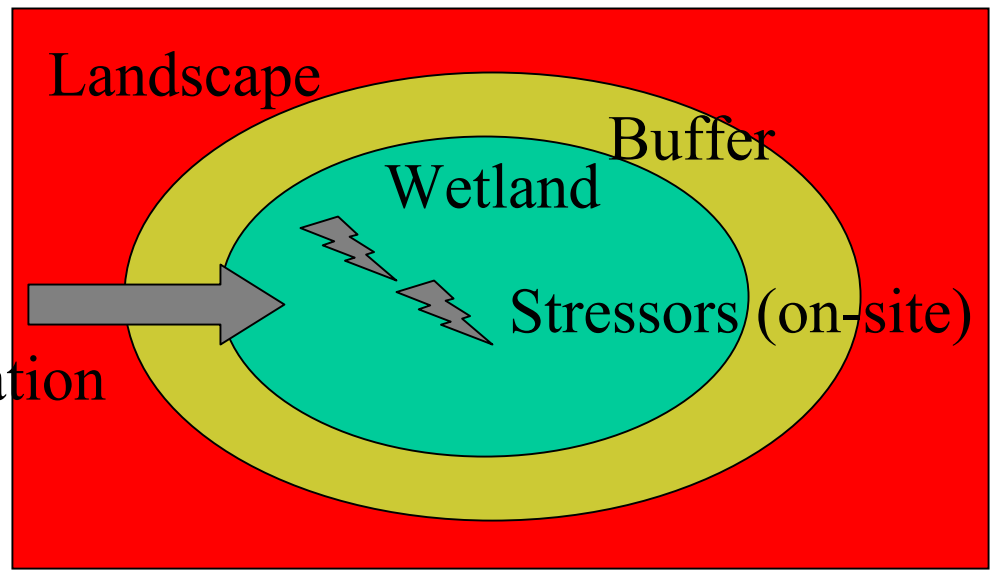
Courtesy of D. Wardrop, Penn State Cooperative Wetland Center

Stressor Checklist

- Hydrologic Modification
- Sedimentation
- Dissolved oxygen
- Contaminant toxicity
- Vegetation alteration
- Eutrophication
- Acidification
- Turbidity
- Thermal Alteration
- Salinity
- Buffer Characteristics

Rapid Assessment Score

A conceptual model of wetland condition:

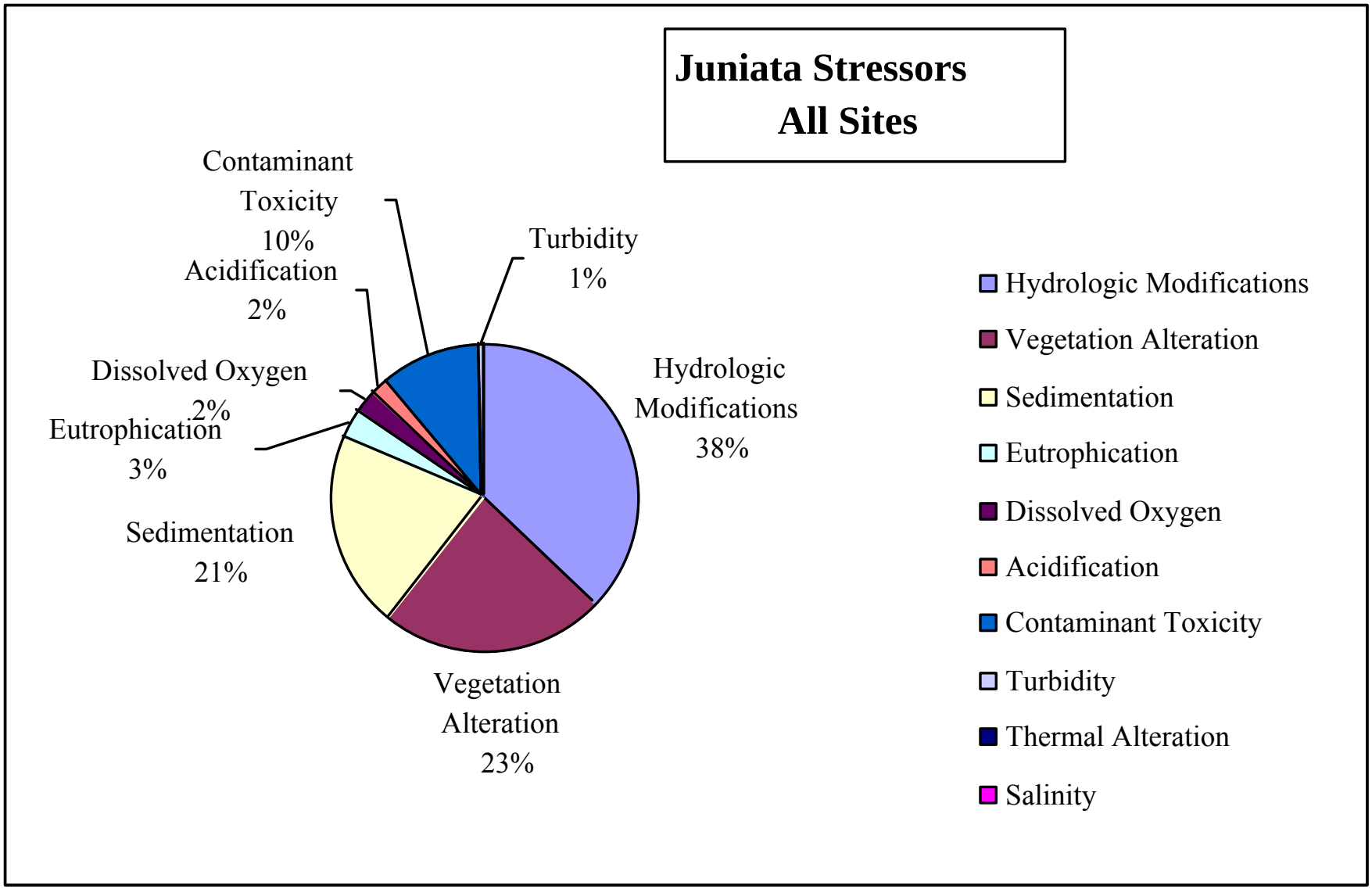


Courtesy of D. Wardrop, Penn State Cooperative Wetland Center

Juniata Watershed—Results of Rapid Assessment (n = 75)

Condition Category	Criteria	Percent of Resource	Area of Wetland (ha)
Best	≥88 Rapid Assessment Score	3.0 ± 3.0	64
Good	≥57 and <88 Rapid Assessment Score	28.0 ± 12.1	594
Fair	≥35 and <57 Rapid Assessment Score	22.8 ± 11.3	484
Poor	<35 Rapid Assessment Score	46.2 ± 11.9	981

From Wardrop, et al. (in prep.)



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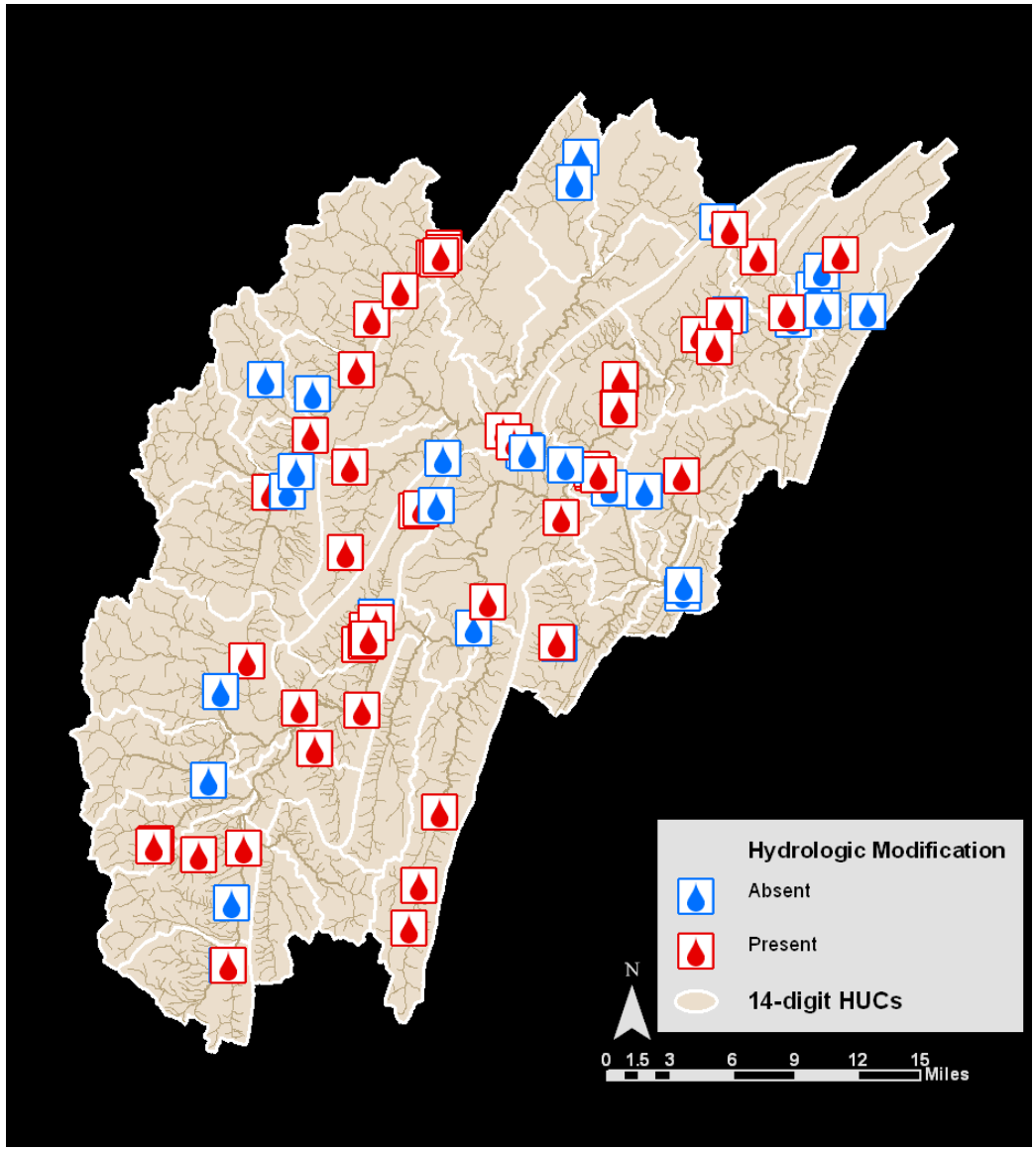

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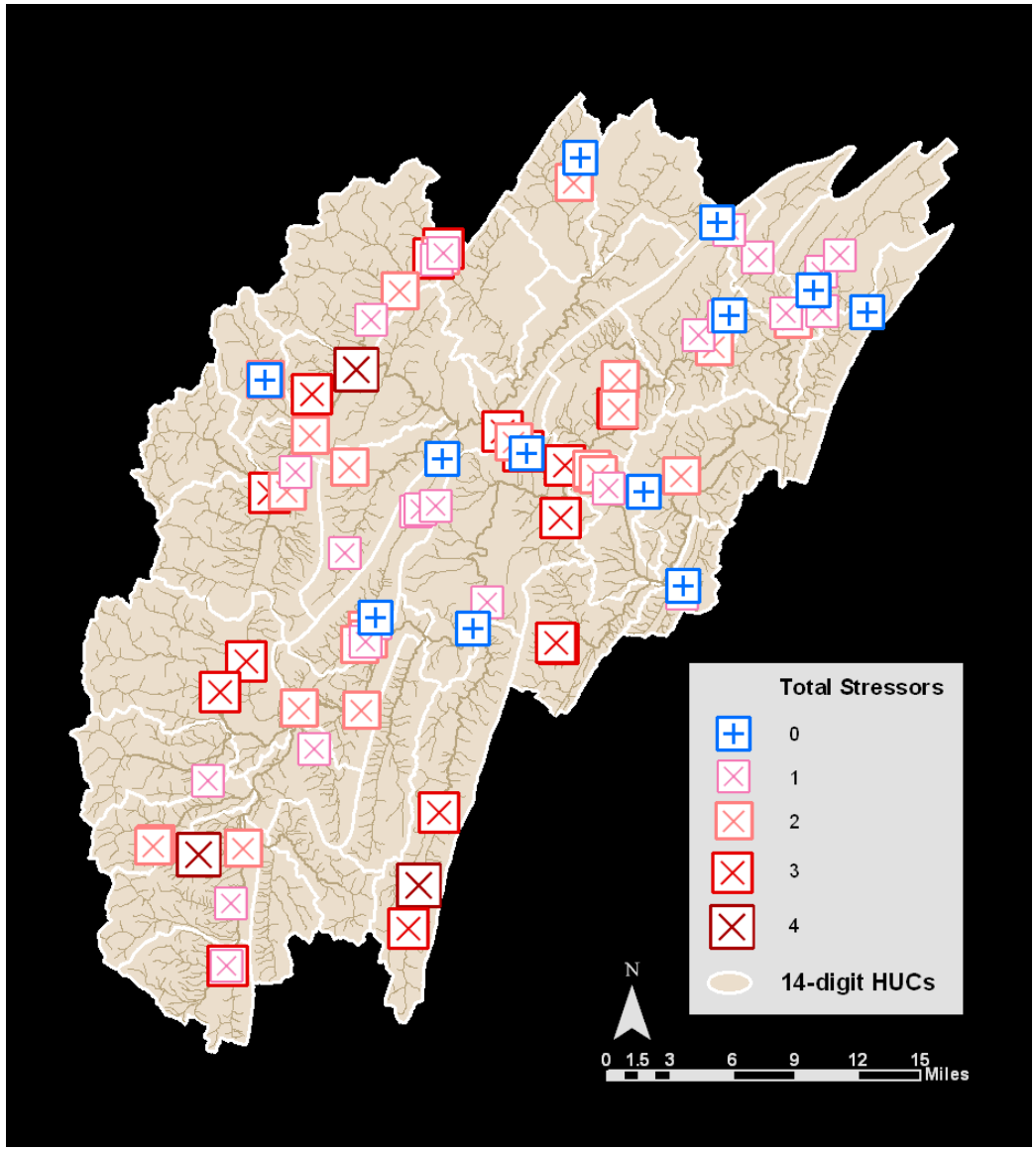


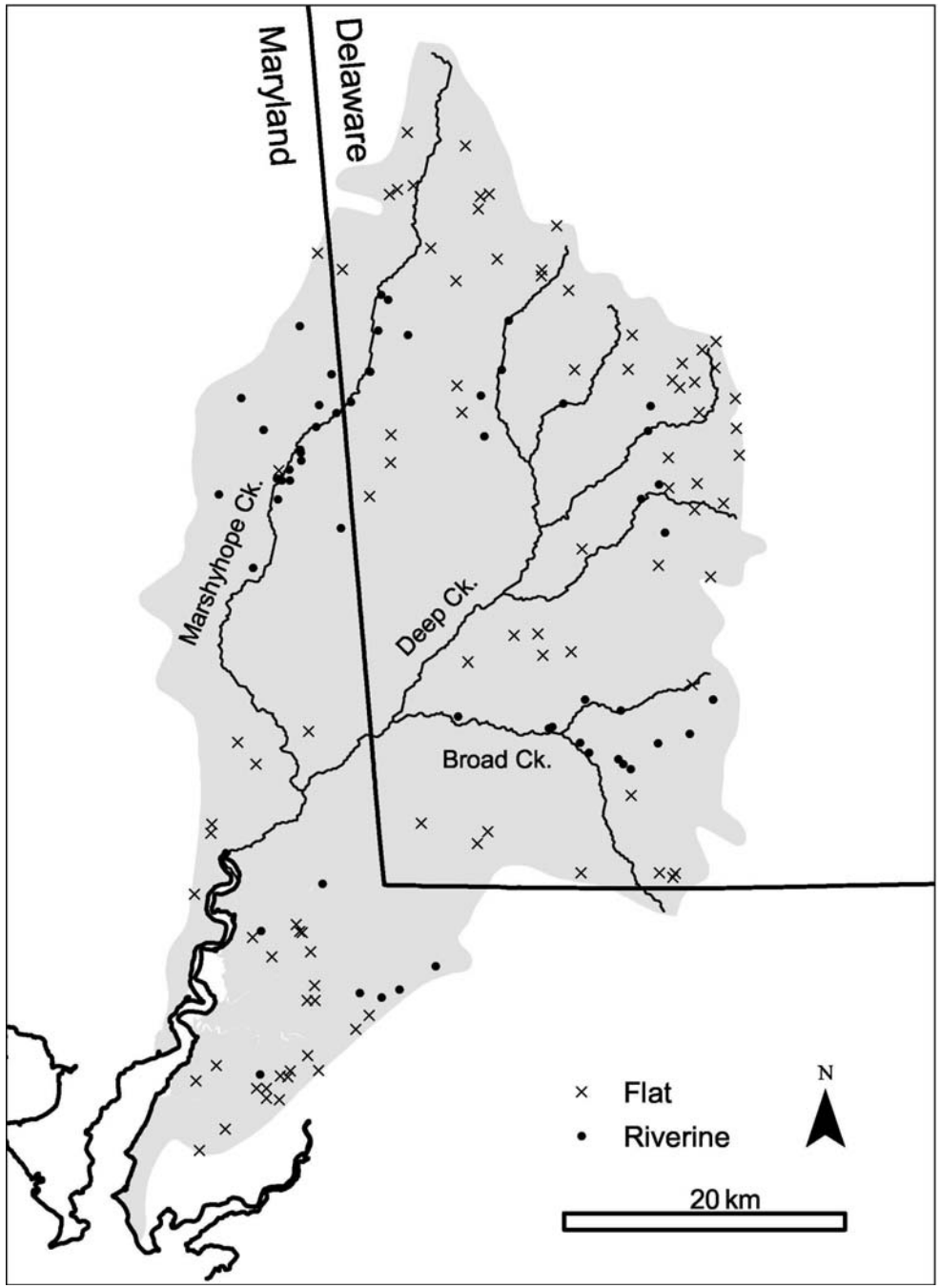
Courtesy of D. Wardrop, Penn State Cooperative Wetland Center

Nanticoke Assessment

187 wetlands sampled

- 79 Riverine
- 108 Flats

From Whigham et al. (2003)



Nanticoke watershed – Riverine wetland (Reference Standard)

Courtesy of D. Whigham, Smithsonian Environmental Research Center

Nanticoke watershed – Riverine wetland (Channelized)

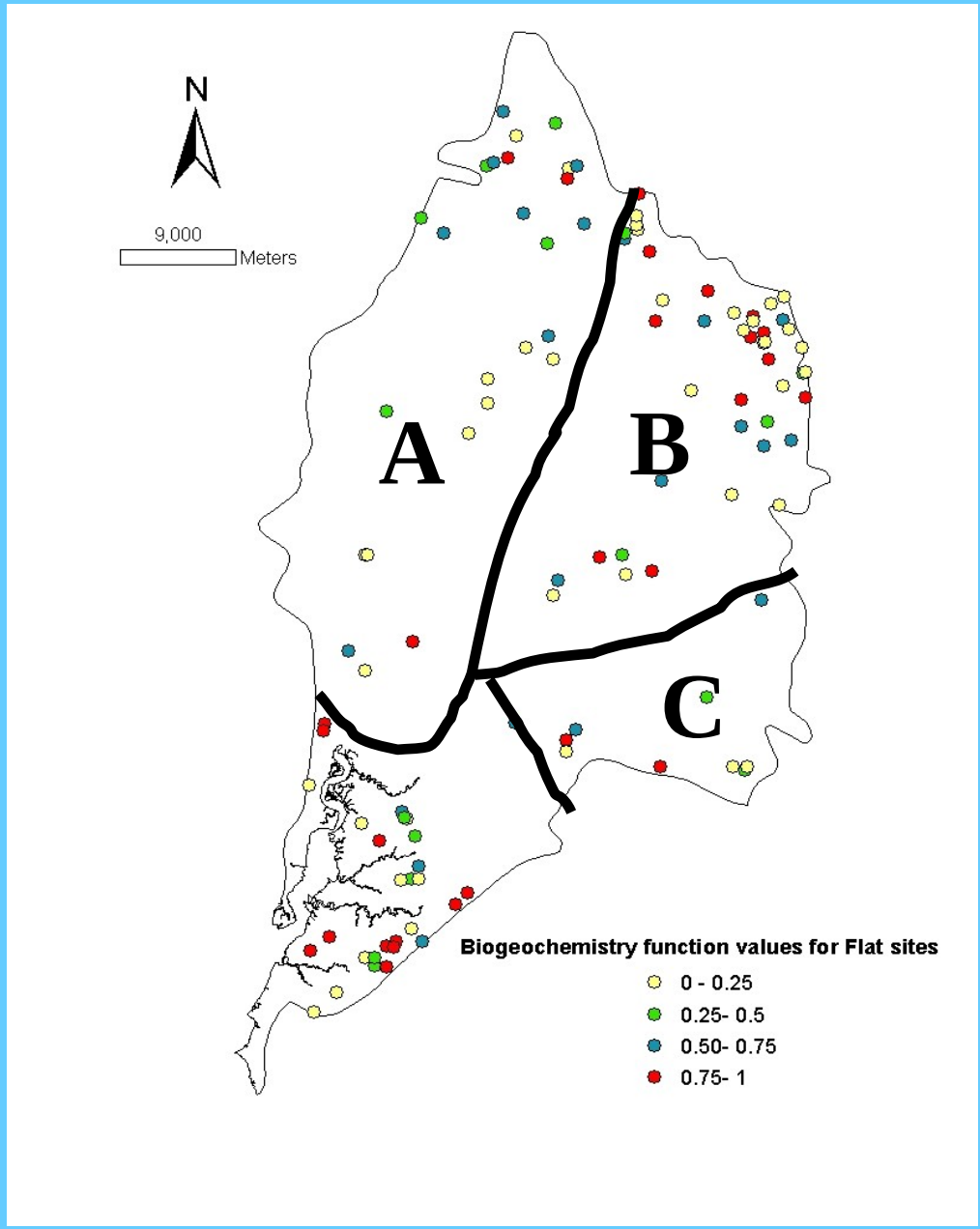
Courtesy of D. Whigham, Smithsonian Environmental Research Center

Nanticoke watershed - Flat (Reference Standard)

Courtesy of D. Whigham, Smithsonian Environmental Research Center

Nanticoke watershed – Flats (Logged site)

Courtesy of D. Whigham, Smithsonian Environmental Research Center



Courtesy of D. Whigham, Smithsonian Environmental Research Center

FCI Scores for Riverine Wetlands in the Nanticoke

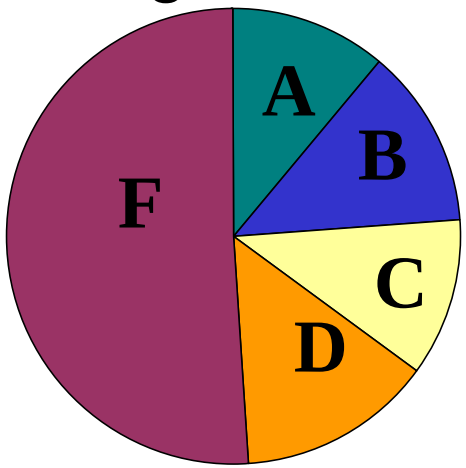
Sub-catchment	Hyd.	Biogeo.	Pt. Comm.	Habitat	Landscape
A	.701	.772	.947	.859	.788
B	.236	.495	.807	.431	.584
C	.683	.759	.809	.727	.770

Adapted from Table 4, Whigham et al. (2003)

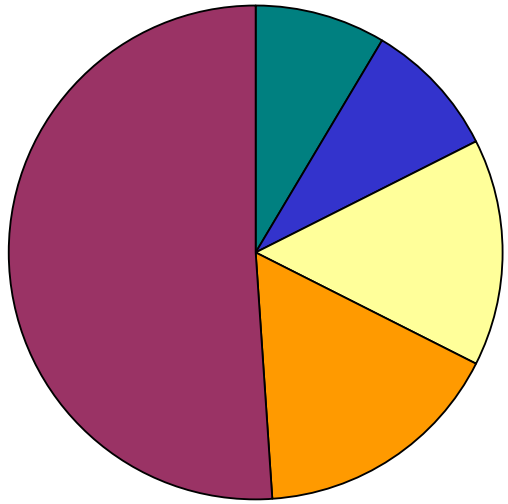
Flats – FCI Scores

Courtesy of D. Whigham

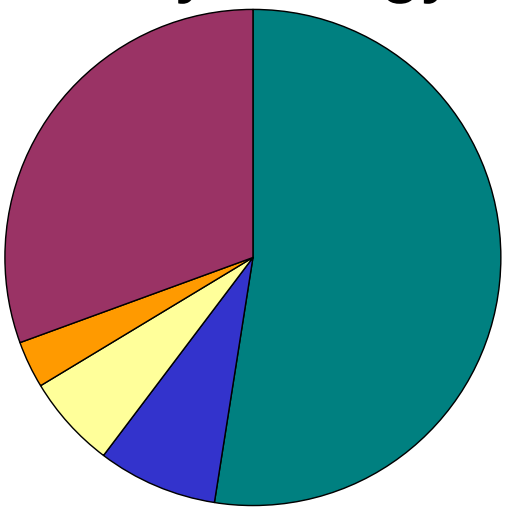
Biogeochemistry



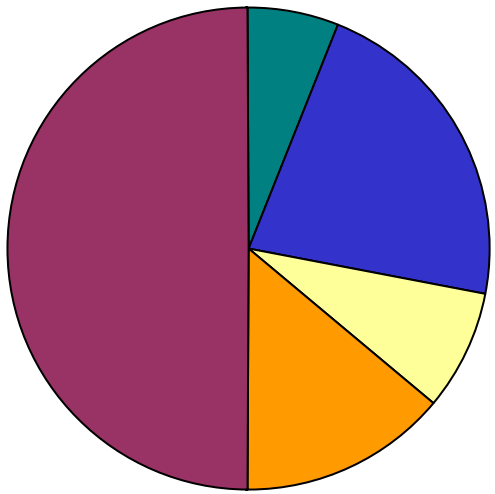
Habitat



Hydrology



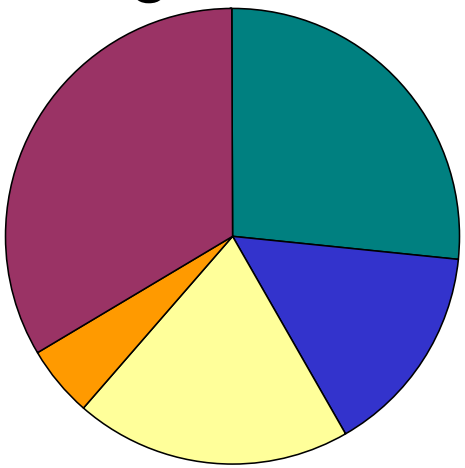
Plant Community



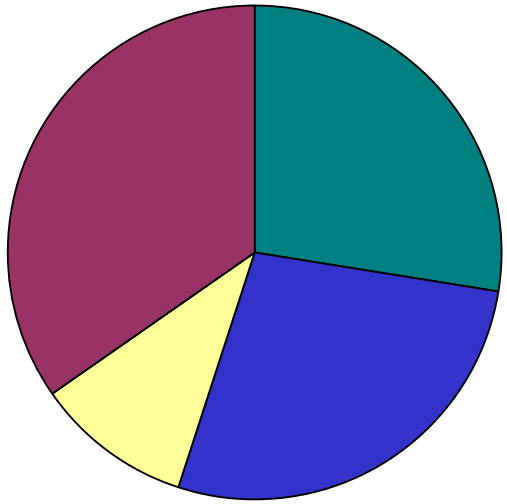
Riverine FCI Scores

Courtesy of D. Whigham

Biogeochemistry



Habitat



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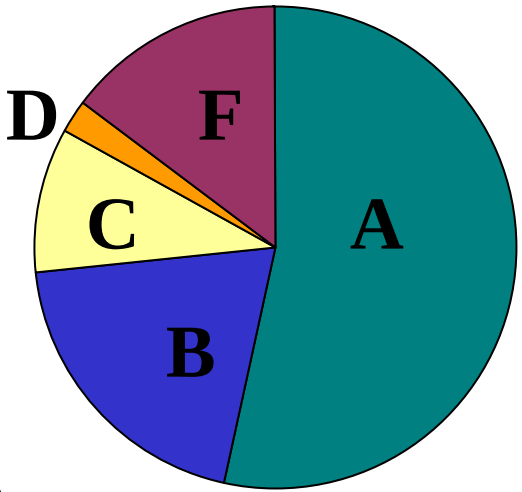

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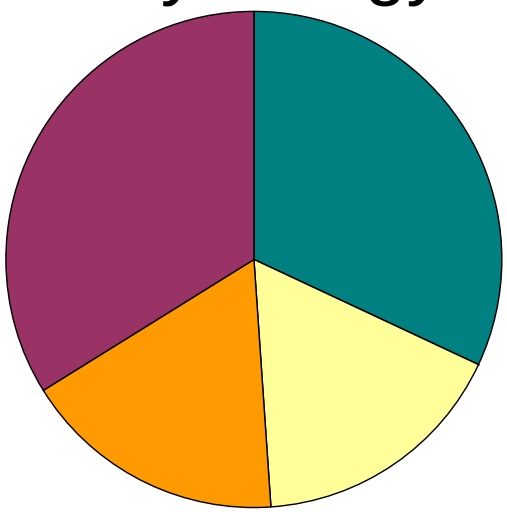
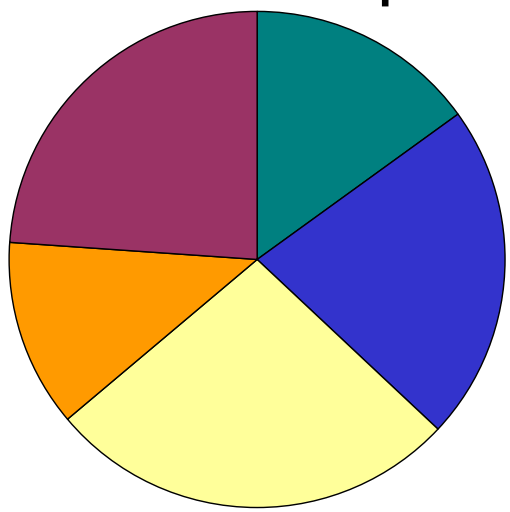


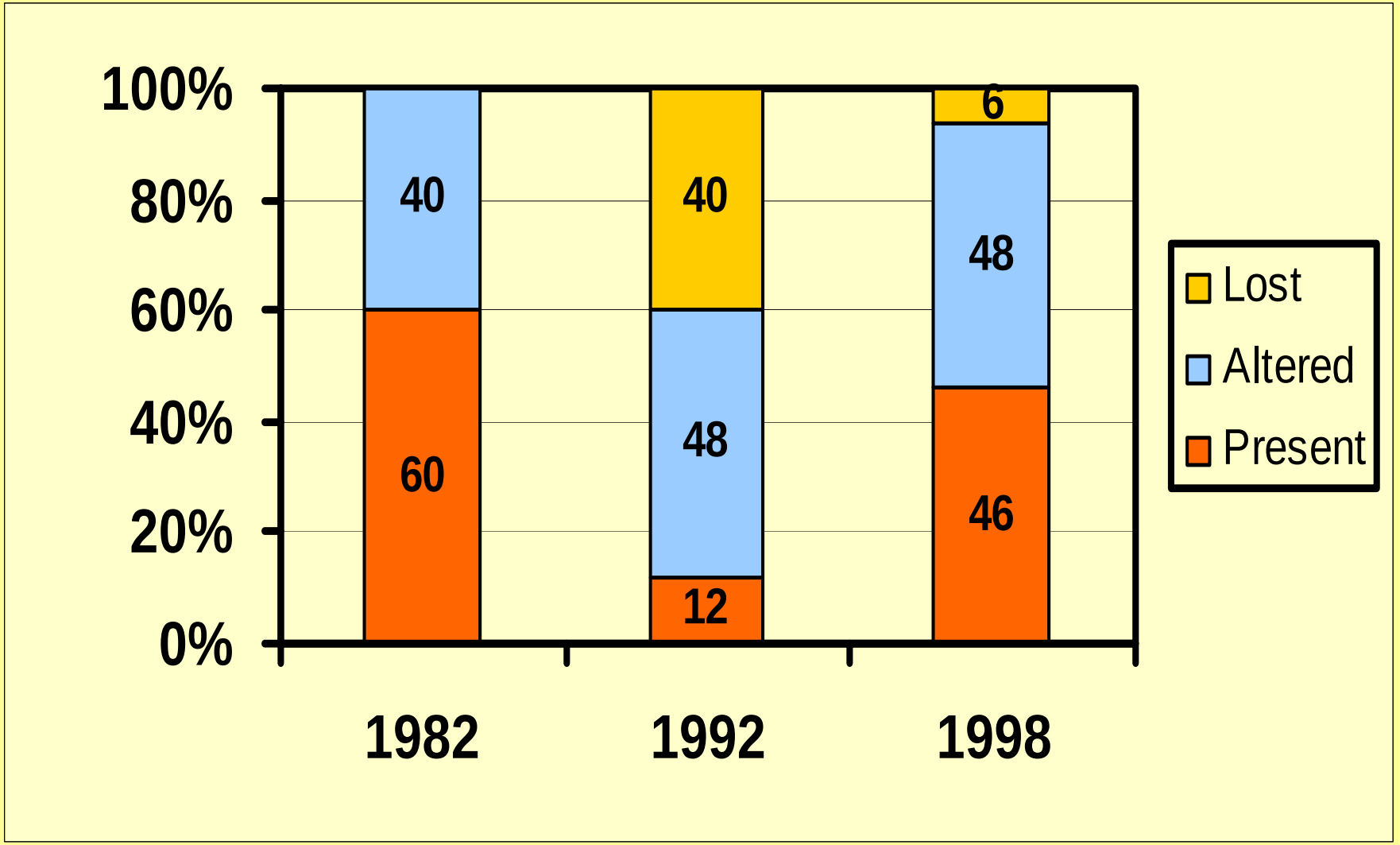
Landscape



Portland, Oregon Mitigation Study

- *Palustrine emergent and open water wetlands <2ha in size*
- *Wetland type most often used as mitigation*
- *Historically common and most often involved in permitting decisions*

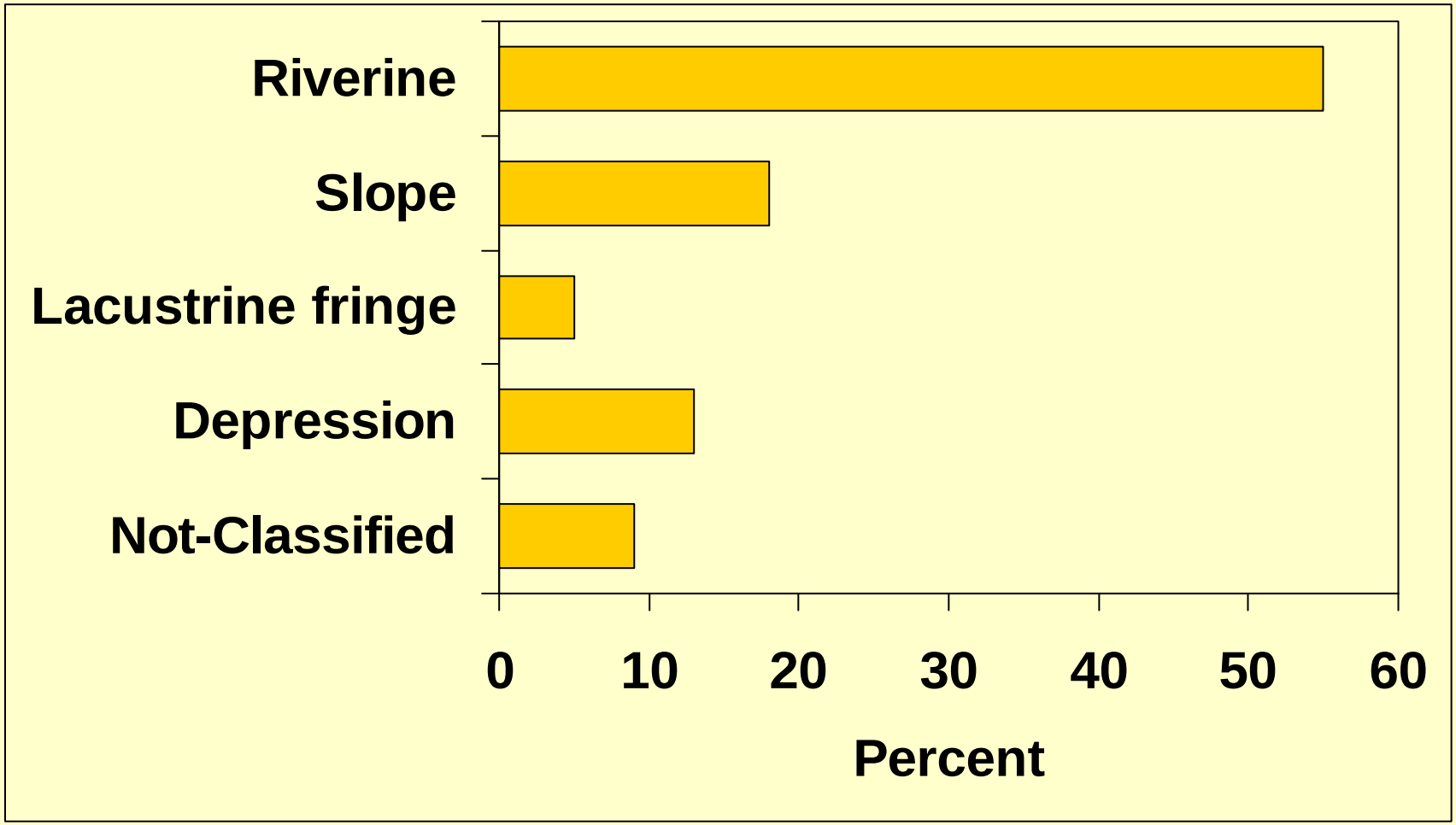
Trends in Time—Portland, OR



From Kentula et al. (in press)

Historic Landscape Profile

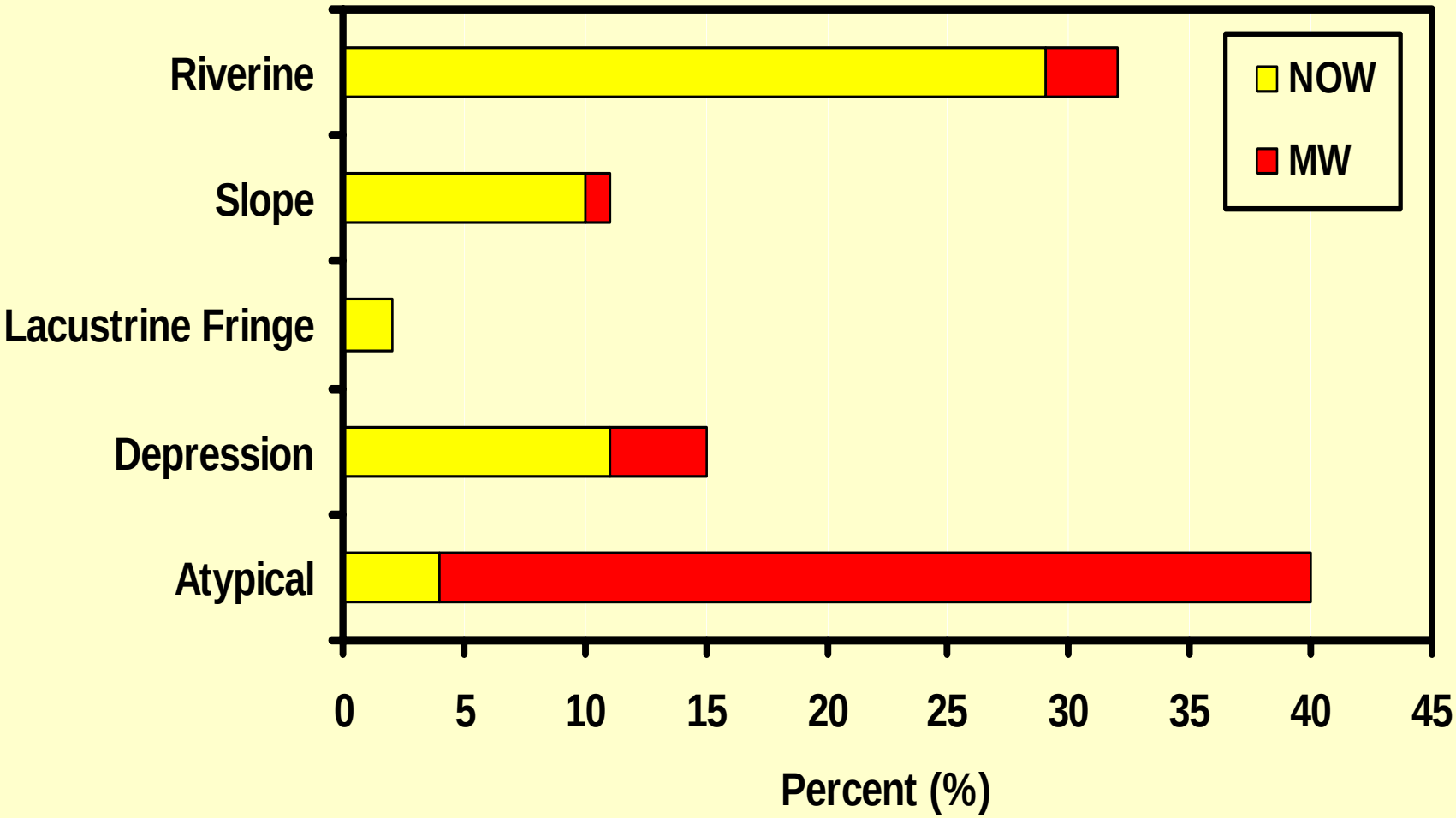
(1993; n = 45)



From Kentula et al. (in press)

Current Landscape Profile

(1998; n = 162 of 188)



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Literature Cited

Kentula, M.E., S.E. Gwin, and S.M. Pierson. In press. Tracking changes with urbanization: sixteen years of experience in Portland, Oregon, USA. Wetlands.

Wardrop, D.H., M.E. Kentula, D.L. Stevens, S. F. Hornsby, and R.P. Brooks. In prep. Regional assessments of wetland condition: an example from the Upper Juniata Watershed in Pennsylvania, U.S.A.

Whigham, D.F., D.E. Weller, A.D. Jacobs, T.E. Jordan, and M.E. Kentula. 2003. Assessing the ecological condition of wetlands at the catchment scale. Landschap 20(2): 99-111.